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(54) Transverse leaf spring type suspension.

(57) Here is disclosed a suspension having an improved transverse leaf spring (11, 21) with its longitudinal axis extending transversely of a car body (10), operatively associated at opposite ends with right and left wheels (14) of a car and curved along its intermediate length in the direction in which the car moves ahead or back. The curved portion may be along a full length of the leaf spring (11) or along a length defined between support points (P) on the leaf spring (21), and in the latter case, lengths extending from the respective support points to the ends of the leaf spring most adjac nt thereto r main linear to form linear portions (21b) substantially in perpendicular to r sp ctive susp nsion arm rocking shafts (4).

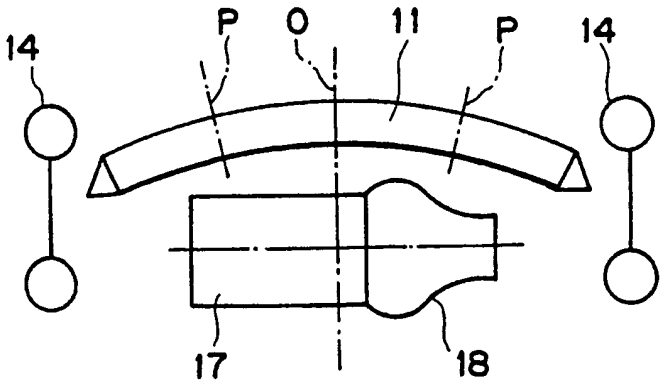

FIG. 1

TRANSVERSE LEAF SPRING TYPE SUSPENSION

FIELD OF THE INVENTION

This invention relates to a transverse leaf spring type suspension for automobile.

BACKGROUND OF THE INVENTION

The transverse leaf spring type suspension including a leaf spring mounted transversely of the car body so as to serve also as a lower arm or upper arm is disclosed, for example, in the Japanese Disclosure Gazette No. 1983-501626 (International Publication No. WO 83/01758). The suspension of this type can do away also with both the coil spring and the stabilizer.

FIG. 4 of the accompanying drawing schematically shows the leaf spring 1 included in the conventional suspension of this type in which the leaf spring 1 serves also as the lower arm, and the wheels 2. The wheels 2 are operatively associated by the respective knuckles with the opposite ends of the leaf spring 1. This leaf spring 1 has a linear longitudinal axis perpendicular to the central axis O of the car body and is supported by the car body at two intermediate support points P.

However, it will be impossible to mount the leaf spring 1 linearly between the right and left wheels 2 when various components such as engine, transmission, differential gear and axle beam between these wheels 2.

Fig. 5 illustrates a relationship between the upper arms 3 and the associated wheels 2. To obtain a suspension geometry for high maneuverability and stability, each rocking shaft L of the associated suspension arm such as the upper arm 3 makes an angle with the central axis O of the car body. When the linear leaf spring 1 is employed in such suspension, the axis of the leaf spring 1 will not be perpendicular to the rocking shafts L, causing a torsional moment to be exerted on the leaf spring 1 at its support points as the wheels 2 vertically move. To achieve a lightweight vehicle, the leaf spring 1 may be formed by use of suitable synthetic resin such as FRP (Fiberglass Reinforced Plastic), but the leaf spring 1 made of such material will not be adequately resistant to said torsional moment and, therefor , the lin ar leaf spring 1 will be inconvenient in this case.

SUMMARY OF THE INVENTION

In view of these problems, a primary object of this invention is to provide a transverse leaf spring type suspension adapted to be mounted between the right and left wheels even when the car components such as the engine are present between said wheels.

Another object of this invention is to provide a leaf spring type suspension having a leaf spring adapted to be free from any significant torsional moment produced due to a vertical movement or other movements of the wheels when the leaf spring is made of material being unable to provide an adequate resistance to said torsional moment.

The objects set forth above are achieved, in accordance with this invention, by a suspension having a transverse leaf spring which has its longitudinal axis extending transversely of a car body, with opposite ends of which right and left wheels are operatively associated, and which is supported at its longitudinally intermediate points by the car body, characterized by that said leaf spring is curved in the direction in which the car moves ahead or back.

Said objects are also achieved, particularly when the leaf spring is made of material being unable to provide an adequate resistance to the torsional moment, according to this invention, by a suspension having a transverse leaf spring which has its longitudinal axis extending transversely of a car body, with opposite ends of which right and left wheels are operatively associated, and which is supported at two or more intermediate points along its length by the car body, characterized by that said leaf spring comprises nonlinear or curved portion(s) defined between said support points and curved in the direction in which the car moves ahead or back and linear portions extending from the outermost support points to the respective adjacent ends.

Elasticity of the leaf spring forming a part of the suspension practically prevents vibration of the car during its running from being transmitted to the car body.

This invention permits the engine to be disposed adjacent the curved portion(s).

Furthermore, said linear portions may be oriented so as to extend substantially in perpendicular to the associated rocking axis of the suspension arms in order that these linear portions are rocked around respective said support points and, with a consequence, the torsional moment possibly exerted on these support points is reduced to the minimum level.

BRIEF DESCRIPTION OF THE DRAWINGS

The transverse leaf spring type suspension of the invention as used with the front wheels of FF car and having the leaf spring serving also as the the lower arm is illustrated, by way of example, in the accompanying drawings in which:

Fig. 1 is a plan view schematically illustrating a relationship between a curved leaf spring and car components such as wheels and an engine;

Fig. 2 is a schematic front view corresponding to Flg. 1;

Fig. 3 is a plan view similar to Fig. 1, illustrating a transverse leaf spring comprising curved portions and linear portions;

Fig. 4 is a plan view schematically illustrating the transverse leaf spring type suspension of prior art: and

Fig. 5 is a plan view schematically illustrating a relationship between respective upper arm rocking shafts and the central axis of a car body.

DESCRIPTION OF THE PREFERED EMBODIMENTS

The transverse leaf spring type suspension constructed in accordance with the present invention will be described, by way of example, in reference with Figs. 1 through 3 of the accompanying drawing.

Referring to Fig. 2 which is a front view schematically illustrates this suspension as mounted in association with the front wheels of FF (Front engine-Front drive) car, a leaf spring 11 having its longitudinal axis extending transversely of a car body 10 serves also as a lower arm and lower ends of respective knuckles 12 are operatively associated with opposite ends of said leaf spring 11 through means such as ball joints. Upper arms 13 are supported by associated rocking shafts L for rocking therearound with respect to the car body 10 and operatively associated at ends remote from the respective rocking shafts L with upper ends of the respective knuckles 12. Knuckle shafts 12a rotatably support respective wheels 14. There are provided adjacent the opposite ends of the leaf spring 11 strut dampers 15 of which upper ends support the car body 10. The leaf spring 11 is supported at intermediate two points P along its length on the car body 10 with interposition of associated mount rubbers 16. Reference symbol O designates a central axis of the car body.

As seen in Fig. 1 which is schematic plan view, the leaf spring 11 is curved in the direction in which the car moves back so that an engine 17 and a transmission 18 may be disposed in a space provided by this curved portion.

The suspension shown by Figs. 1 and 2 operates in such a manner as will be described below.

Referring to Fig. 2, vertical movement of the wheels 14 causes the respective upper arms 13 to be rocked around the associated rocking shafts L. Simultaneously, the portions of the leaf spring 11 extending from the respective support points P to the adjacent ends are rocked around the associated support points P. Thus, elasticity of the leaf spring 11 allows such vertical movement of the wheels 14 relative to the car body 10 minimizing transmission of the vibration to the car body 10.

The car components such as the engine 17 and the transmission 18 can be located in the space provided by the curved portion of the leaf spring 11, so the suspension having the transverse leaf spring 11 can be employed even when said components such as the engine 17 are present between the right and left wheels 14.

Fig. 3 is a plan view similar to Fig. 1 and schematically illustrates the leaf spring 21 having a configuration which is preferable particularly when said leaf spring 21 is made of material being unable to provide an adequate resistance to a possible torsional moment. The leaf spring 21 of this suspension is provided with right and left support points P and a portion extending between these support points P is curved in the direction in which the car moves back to form a curved portion 21a. Portions extending from the respective support points P to the adjacent ends of the leaf spring 21 form respective linear portions 21b having orientations defined respectively by tangent lines at the respective support points P of said curved portion 21a. These linear portions 21b extend towards the associated wheels 14 substantially in perpendicular to the respective rocking shafts L of the upper arms 13, each of the rocking shafts L making an angle with the central axis O of the car. The wheels 14 are operatively associated, in the same manner as has previously been mentioned, with outer ends of the respective linear portions 21b through the knuckles 12.

The suspension of Fig. 3 operates as follows:

Vertical movement of the wheels 14 causes, in the same manner as has been mentioned above, the upper arms 13 to be rocked around the associated rocking shafts L and simultaneously the ends of the leaf spring 11 are rocked around the respective support points P. Thus, transmission of vibration to the car body is substantially avoided.

In the case of the leaf spring 11 having the portions extending from the respective support points P to the adjacent ends which are also

curved as shown in Fig. 1, these portions are not perpendicular to the rocking shafts L of the associated upper arms 13 but have their orientations varying point to point. With a consequence, direction of a force exerted on each point along said portions varies as the wheels 14 vertically move, producing a high torsional moment exerted on the support points P. Accordingly, the leaf spring 11 of this configuration is not preferable in regard to a strength required to resist such high torsional moment and when the leaf spring 11 is made of synthetic resin such as FRP, no adequate durability can be expected.

But if the linear portions 21b are substantially perpendicular to the associated rocking shafts L as in the leaf spring 21 shown by Fig. 3, a torsional moment possibly exerted on each of said linear portions 21b will be substantially lower than that exerted on the corresponding portion which is curved. With a consequence, the leaf spring 21 may be made of FRP or other synthetic resin.

Although the embodiment has been described hereinabove as having a pair of support points P along the length of the leaf spring, it is also possible to provide the leaf spring along its length with four support points P, more specifically, a pair of support points P along the right half and another pair of support points P along the left half of the length. When there are provided a plurality of support points along the right and left halves of the length, respectively, it is preferable that the portions of the leaf spring respectively defined between a pair of support points most adjacent to the associated wheels 14 are formed as curved portions 21a while the portions respectively defined between the respective outermost support points P and the ends adjacent thereto are formed as linear portions 21b.

Although this embodiment has been illustrated with the leaf spring serving also as the lower arm, it is also possible within the scope of this invention that the leaf spring serves also as the upper arm or there is provided the leaf spring separately of the suspension arms. Furthermore, the suspension of this invention may be also mounted on the rear wheels or FR (Front engine-Rear drive) car, although the embodiment has been discussed above in connection with the front wheels of FF car.

As will be apparent from the foregoing description, the transverse leaf spring type suspension constructed in accordance with this invention has the leaf spring being so curved to define a space within which the car components such as the engine and the differential gear, so the transverse leaf spring may be adopted even when said car components are present between the right and left wheels. When the suspension arms have the rocking shafts each making an angle with the central axis of the car body, the invention allows the leaf spring to extend somewhat in perpendicular to these rocking shafts, so that the torsional moment possibly exerted on this leaf spring is smaller than that exerted on the linear leaf spring and the durability of the leaf spring is thereby improved.

By forming the portions of the leaf spring extending from the respective points at which the leaf spring is supported on the car body to the ends adjacent to the respective support points as the linear portions, it is possible to make the leaf spring extend substanially in perpendicular to the respective rocking shafts of the suspension arms. Thereby the torsional moment possibly exerted on the leaf spring is further reduced than that exerted on the leaf spring curved along its full length and synthetic resin such as FRP can be used as material for the leaf spring. Thus, it is possible to realize a light weight leaf spring and, therefore, a light weight car. Furthermore, the respective rocking shafts of the suspension arms can be inclined with respect to the central axis of the car body, increasing the degree of freedom for design and achieving the transverse leaf spring type suspension having a suspension geometry preferable for maneuverability and stability.

Claims

1. A transverse leaf spring type suspension comprising a transverse leaf spring operatively associated at opposite ends with right and left wheels of a car, said leaf spring being supported, at intermediate points along its length, by a car body, and said leaf spring being curved in the direction in which the car moves ahead or back.

2. A transverse leaf spring type suspension as recited in Claim 1, wherein the leaf spring serves also as a lower arm.

3. A transverse leaf spring type suspension as recited in Claim 1, wherein the leaf spring serves also as an upper arm.

4. A transverse leaf spring type suspension comprising a transverse leaf spring operatively associated at opposite ends with right and left wheels of a car, said leaf spring being supported, at intermediate two points along its length, by a car body, said leaf spring being curved along a length defined between said two points in the direction in which the car moves ahead or back so as to form a curved portion, and lengths extending from the respective support points to the ends of the leaf spring most adjacent thereto remaining linear so as to form linear portions.

5. A transvers leaf spring type suspension comprising a transverse leaf spring operatively associated at opposite ends with right and left wheels

of a car. said leaf spring being supported, at intermediate two points along its length, by a car body, said leaf spring being curved along a length defined between said two support points in the direction in which the car moves ahead or back so as to form a curved portion, and lengths extending from the respective support points to the ends of the leaf spring most adjacent thereto remaining linear so as to form linear portions substantially in perpendicular to respective suspension arm rocking shafts.

6. A transverse leaf spring type suspension as recited in Claim 4 or 5, wherein the leaf spring serves also as a lower arm.

7. A transverse leaf spring type suspension as recited in Claim 4 or 5, wherein the leaf spring serves also as an upper arm.

8. A transverse leaf spring type suspension as recited in Claim 6 or 7, wherein the leaf spring is made of synthetic resin.

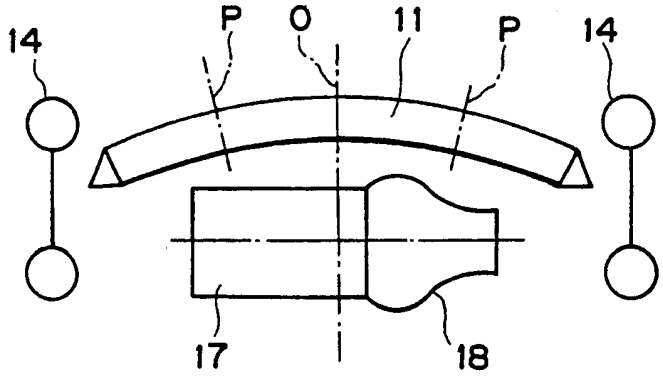

FIG. 1

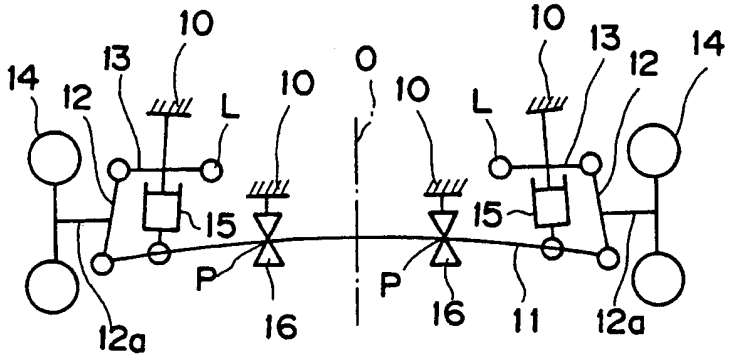

FIG. 2

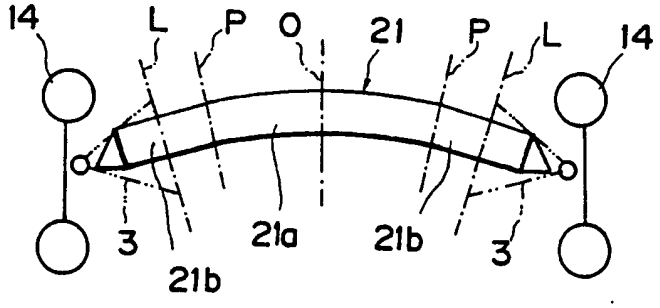

FIG. 3

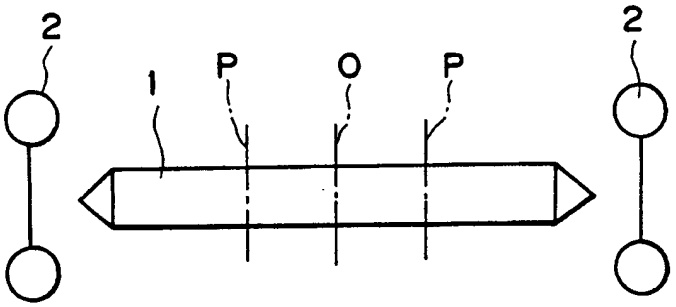

FIG. 4

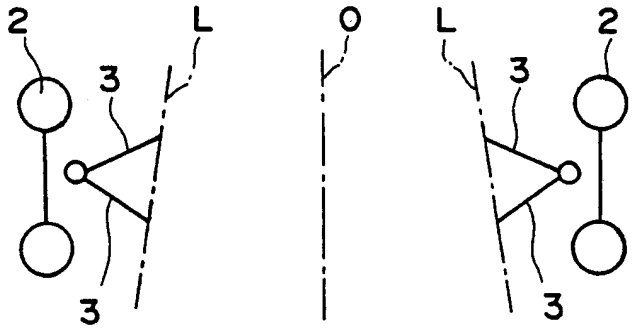

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number

EP 88 11 8975

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-0 243 102 (GKN TECHNOLOGY LTD) * Page 6, line 20 - page 9, line 14; figures 1-7 *	1,2,4	B 60 G 11/08 F 16 F 1/18 B 60 G 3/28 B 60 G 21/04
Y	* Page 5, lines 4-22; page 8, lines 19-25; figures 1,7 *	5,6,8	
Y	US-A-2 697 613 (GIACOSA) * Front page, column 2, lines 3-7; figure 1 *	5,6,8	
X	US-A-2 458 548 (ARONSON) * Front page, column 1, lines 29-39; figure 3 *	1-3	
A	N.P. CHIRONIS: "Spring design and application", 1961, chapter 10, pages 242-246, McGraw-Hill Book Co. Inc., New York, US * Page 244, figure 5 *	1,4,5	
A	EP-A-0 189 241 (FORD) * Page 4, lines 24-27; page 7, claim 6; page 8, claim 7; figure 2 *	3,7	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	US-A-4 422 666 (PROCTOR) * Whole document *	1,4,5	B 60 G F 16 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-01-1989	MEIJS P.C.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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